Draft Charge for the BOSC Subcommittee
Review of the Land Preservation and Restoration Research Program

1.0 Objective. The objective of this review is to evaluate the relevance, quality, performance, and scientific leadership of ORD's Land Preservation and Restoration Research Program. The panel's evaluation and recommendations will provide guidance to the Office of Research and Development to help:

- plan, implement, and strengthen the program;
- compare the program with programs designed to achieve similar outcomes in other parts of EPA and in other federal agencies;
- make research investment decisions over the next five years;
- prepare EPA's performance and accountability reports to Congress under the Government Performance and Results Act; and
- respond to evaluations of federal research such as those conducted by the Office of Management and Budget (OMB highlights the value of recommendations from independent expert panels in guidance to federal agencies[1,2]).

2.0 Background Information. Independent expert review is used extensively in industry, federal agencies, Congressional committees, and academia. The National Academy of Science has recommended this approach for evaluating federal research programs.[3]

Because of the nature of research, it is not possible to measure the creation of new knowledge as it develops–or the pace at which research progresses or scientific breakthroughs occur. Demonstrating research contributions to outcomes is very challenging[4] when federal agencies conduct research to support regulatory decisions, and then rely on third parties[5]–e.g. OSWER and the EPA Regions –to conduct remediation or other actions to demonstrate environmental improvements. Typically, many years may be required for practical research applications to be developed and decades may be required for some research outcomes to be achieved.

Most of EPA's environmental research programs investigate complex environmental problems and processes–combining use-inspired basic research[6,7] with applied research, and integrating several scientific disciplines across a conceptual framework[8] that links research to environmental decisions or environmental outcomes. In multi-disciplinary research programs such as these, progress toward outcomes can not be measured by outputs created in a single year. Rather, research progress occurs over several years, as research teams explore hypotheses with individual studies, interpret research findings, and then develop hypotheses for future studies.

In designing and managing its research programs, ORD emphasizes the importance of identifying priority research questions to guide the research. Similarly, ORD recommends that its programs develop a small number of performance goals which serve as indicators of progress. Short-term outcomes are accomplished when research is applied by specific clients to strengthen environmental decisions or regulations. These decisions and resulting actions (e.g., the reduction of contaminant exposures or the restoration of ecosystems) ultimately contribute to improved environmental quality and health.

In a comprehensive evaluation of science and research at EPA, the National Research Council recommended[9] that the agency substantially increase its efforts to explain the significance of its research products and to assist clients inside and outside the agency in applying them. In response to this recommendation, ORD has engaged science advisors from client organizations to serve as members of its research program teams. These teams help identify research contributions with significant decision-making value and help plan for their transfer and application.

For EPA's environmental research programs, periodic retrospective analysis at intervals of four or five years is needed to characterize research progress, to identify when clients are applying research to strengthen environmental decisions, and to evaluate client feedback about the research. Conducting program evaluation at this interval enables assessment of research progress, the scientific quality and decision-making value of the research, and whether research progress has resulted in short-term outcomes for specific clients. Such an assessment also allows a prospective evaluation to ensure programmatic themes and priorities are linked to strategic goals and outcomes, and the rationales justifying the program are effectively developed and communicated.

A description of the OSTP/OMB *Research and Development Investment Criteria* is included in Appendix I.

3.0 Draft Charge Questions for ORD's Land Research Program

In your review of the draft Land Multi-Year Plan (MYP), also consider additional information from the EPA Strategic Plan, the SAB review of the Contaminated Sites and RCRA MYPs, and other documents and presentations submitted as background information. The BOSC is asked to provide comments on the following areas to assist in assessing the program's relevance, performance, quality, and leadership, retrospectively, and its proposed directions and management priorities, prospectively:

Relevance

1. Is the research program relevant to and consistent with Agency goals, customer needs, and is it sufficiently flexible?

Please comment on the extent to which the research has been, and plans to be, responsive to Agency and other stakeholder needs and priorities. Please comment on ORD's application of processes to adjust to changing priorities and resources to maintain or enhance relevance.

- Factors to consider: Is the focus of ORD's Land Research Program relevant to and consistent with the Agency's strategic goals and responsive to recommendations from the SAB 2004 review of the Contaminated Sites and RCRA MYP? Does the program MYP have clear goals and priorities and are these justified and communicated

effectively? Are potential public benefits of the program clearly articulated? Are stakeholders (e.g., Program and Regional Offices) involved in the planning and prioritization of the research? Is the program responsive to Agency and other stakeholder needs and priorities? Are outputs from the Program used by stakeholders? Is the Program well-coordinated with outside research organizations, nationally and internationally, to avoid duplication of effort and promote synergistic collaboration? To what extent do research program staff participate on or contribute to Agency work groups and transfer research products to the program office, regions, and other clients?

Quality

2. How is quality ensured in the awarding of research funds and in the quality of research products?

Please comment on the process the program uses to prioritize research areas and allocate funds. Does this process ensure that quality is maintained? Does the program use peer review to ensure the quality of its products?

- Factors to consider: Does this problem-driven research program conduct internal and external peer reviews of the research. Does the research program adjust in response to these reviews to maintain quality? Has the program used competitive merit based process to award extramural funds? If funds are not competitively awarded, what process does the Program use to allocate funds? Does this process ensure that quality is maintained?

Performance

3. Is the research program design logical and appropriate?

Please comment on the goals and priorities of the draft Land MYP, including the selection of long-term goals (LTGs), linkage of the LTGs to desired outcomes, and responsiveness to key science questions and Agency and Program priorities.

- Factors to consider: Does the Program have a logical, comprehensive design and a MYP, with clear goals, schedules, and priorities? Is the research program appropriately leveraged and coordinated with others working in these areas. Does the MYP describe an appropriate flow of work? Does the research address the key research questions? Is the rationale to address the questions clearly articulated? Does the ORD Program use this MYP to address a logical sequence of questions and does it use the plan as a basis for prioritizing its work? Does the MYP respond to SAB recommendations for developing a holistic MYP from the predecessor plans?

4. Is the research program making timely progress in addressing key scientific questions and LTGs?

The draft Land MYP has identified two Long-Term Goals, under which key science questions are aligned. Please comment on the degree of progress that has been made in addressing each of the Long-Term Goals and associated key research questions and usefulness of the MYP for mapping progress in the future.

- Factors to consider: Has ORDs Program clearly articulated its focus and the rationale behind its approach to study these long term goals? Do these LTGs constitute logical focal points for planning the research and for identifying long-term priorities that meet the scientific needs of the Agency and Program customers? Has the Program made significant progress toward each of the long-term goals. Are the questions being addressed in a timely manner? Has the Program met stakeholder needs in a timely and useful way? Is there evidence for application of products and knowledge by clients that would lead toward achieving program outcomes? Has the Program been effective in developing and communicating outputs that support the risk assessment/risk management process?

Scientific Leadership

5. Is ORD playing a leadership role in Land research and effectively collaborating with the larger research community?

Please comment on the leadership role the Land research program and its staff have in contributing to advancing the state of science and practice. Has the EPA collaborated with other agencies (inside and outside the government) in advancing the EPA's research agenda? Recognizing that other organizations have substantial resources for related work, has ORD allocated its resources to EPA's best advantage?

- Factors to consider: the degree to which this program and its staff are identified as leaders in the field; inclusion of ORD staff in national and international science and technology professional bodies; effectiveness of communication and collaboration with clients and stakeholders; coordination and leveraging with related research programs; and participation of ORD staff and inclusion of ORD products in program guidance and practice.

4.0 Potential Peer-Review Panel Approach for Program Review

- Hold up to three conference calls in the month preceding a face-to-face meeting.
    - allows the ORD to present background materials to the Peer-Review Panel
    - allows the Peer-Review Panel to review and comment on the charge
    - allows the Peer-Review Panel to ask clarifying questions about the program under review

- The Contractor shall distribute background materials and documents requested by the Peer-Review Panel in advance of the progress review.

- The Peer-Review Panel Chair makes review and writing assignments to Panel members in advance of a face-to-face meeting.

- Hold a 2-3 day face-to-face meeting for the Program review at a location where a critical mass of ORD scientists is located.
    - The first 2 days of the meeting will involve ORD presentations and poster sessions.
    - On the morning of the third day of the meeting, the Peer-Review Panel prepares a draft report that addresses all of the charge questions.
    - It is a goal to have a draft report available for circulation and comment at the end of the face-to-face meeting.

- If needed, hold 1-2 conference calls to finalize the report at least one month after the face-to-face meeting.
    - It is a goal to have a final report approved by the Peer-Review Panel available to ORD within one month following the face-to-face meeting.

References

[1] Budget Data Request 04-31. Executive Office of the President, Office of Management and Budget. March 22, 2004. "Completing the Program Assessment Rating Tool (PART) for the FY06 Review Process," pages 50-56.

[2] Memorandum for the Heads of Executive Departments and Agencies. Executive Office of the President, Office of Management and Budget. June 5, 2003. "FY 2005 Interagency Research and Development Priorities," pages 5-10.

[3] Evaluating Federal Research under the Government Performance and Results Act (National Research Council, 1999).

[4] The House Science Subcommittee. Letter to Dr. Bruce Alberts, President of the National Academy of Sciences, from F. James Sensenbrenner, Jr. and George E. Brown. October 23, 1997.

[5] The Government Performance and Results Act: 1997 Government wide Implementation Will Be Uneven. U.S. General Accounting Office. (GAO/GGD, 1997).

[6] Building a Foundation for Sound Environmental Decisions. (National Research Council, 1997).

[7] "Renewing the Compact between Science and Government," Stokes, D.E., in 1995 Forum Proceedings, Vannevar Bush II—Science for the 21st Century. Pages 15-32. Sigma Xi, 1995.

[8] Risk Assessment in the Federal Government: Managing the Process. (National Research Council, 1983).

[9] Strengthening Science at the U.S. Environmental Protection Agency. (National Research Council, 2000, p 141).

Appendix I

OSTP/OMB Research and Development Investment Criteria

The Relevance, Quality, and Performance criteria apply to all R&D programs. Industry-relevant applied R&D must meet additional criteria. Together, these criteria can be used to assess the need, relevance, appropriateness, quality, and performance of federal R&D programs.

I. Relevance

R&D investments must have clear plans, must be relevant to national priorities, agency missions, relevant fields, and "customer" needs, and must justify their claim on taxpayer resources. Review committees should assess program objectives and goals on their relevance to national needs, "customer" needs, agency missions, and the field(s) of study the program strives to address. For example, the Joint DOE/NSF Nuclear Sciences Advisory Committee's Long Range Plan and the Astronomy Decadal Surveys are the products of good planning processes because they articulate goals and priorities for research opportunities within and across their respective fields. Programs that directly address Presidential priorities may receive special consideration for support, with adequate documentation of their relevance to those priorities.

OMB will work with some programs to identify quantitative metrics to estimate and compare potential benefits across programs with similar goals. Such comparisons may be within an agency or among agencies.

A. Programs must have complete plans, with clear goals and priorities. Programs must provide complete plans, which include explicit statements of: -specific issues motivating the program; -broad goals and more specific tasks meant to address the issues; -priorities among goals and activities within the program; -human and capital resources anticipated; and -intended program outcomes, against which success may later be assessed.

B. Programs must articulate the potential public benefits of the program. Programs must identify potential benefits, including added benefits beyond those of any similar efforts that have been or are being funded by the government or others. R&D benefits may include technologies and methods that could provide new options in the future, if the landscape of today's needs and capabilities changes dramatically. Some programs and sub-program units may be required to quantitatively estimate expected benefits, which would include metrics to permit meaningful comparisons among programs that promise

similar benefits. While all programs should try to articulate potential benefits, OMB and OSTP recognize the difficulty in predicting the outcomes of basic research. Discovery is a legitimate object of basic research, and some basic research investments may be justified on external judgments of the opportunity for discovery.

C. Programs must document their relevance to specific Presidential priorities to receive special consideration. Many areas of research warrant some level of federal funding. Nonetheless, the President has identified a few specific areas of research that are particularly important. To the extent a proposed project can document how it directly addresses one of these areas, it may be given preferential treatment.

D. Program relevance to the needs of the Nation, of fields of science and technology, and of program "customers" must be assessed through prospective external review. Programs must be assessed on their relevance to agency missions, fields of science or technology, or other "customer" needs. A customer may be another program at the same or another agency, an interagency initiative or partnership, or a firm or other organization from another sector or country. As appropriate, programs must define a plan for regular reviews by primary customers of the program's relevance to their needs. These programs must provide a plan for addressing the conclusions of external reviews.

E. Program relevance to the needs of the Nation, of fields of science and technology, and of program "customers" must be assessed periodically through retrospective external review. Programs must periodically assess the need for the program and its relevance to customers against the original justifications. Programs must provide a plan for addressing the conclusions of external reviews.

II. Quality

Programs should maximize the quality of the R&D they fund through the use of a clearly stated, defensible method for awarding a significant majority of their funding. A customary method for promoting R&D quality is the use of a competitive, merit-based process. NSF's process for the peer-reviewed, competitive award of its R&D grants is a good example. Justifications for processes other than competitive merit review may include "outside-the-box" thinking, a need for timeliness (e.g., R&D grants for rapid studies in response to an emergency), unique skills or facilities, or a proven record of outstanding performance (e.g., performance-based renewals).

Programs must assess and report on the quality of current and past R&D. For example, NSF's use of Committees of Visitors, which review NSF directorates, is an example of a good quality-assessment tool. OMB and OSTP encourage agencies to provide the means by which their programs may be benchmarked internationally or across agencies, which provides one indicator of program quality.

A. Programs allocating funds through means other than a competitive, merit-based process must justify funding methods and document how quality is maintained. Programs must clearly describe how much of the requested funding will be broadly competitive based on merit, providing compelling justifications for R&D funding allocated through other means. (See OMB Circular A-11 for definitions of competitive merit review and other means of allocating federal research funding.) All program funds allocated through means other than unlimited competition must document the processes they will use to distribute funds to each type of R&D performer (e.g., federal laboratories, federally funded R&D centers, universities). Programs are encouraged to use external assessment of the methods they use to allocate R&D and maintain program quality.

B. Program quality must be assessed periodically through retrospective expert review. Programs must institute a plan for regular, external reviews of the quality of the program's research and research performers, including a plan to use the results from these reviews to guide future program decisions. Rolling reviews performed every 3-5 years by advisory committees can satisfy this requirement. Benchmarking of scientific leadership and other factors provides an effective means of assessing program quality relative to other programs, other agencies, and other countries.

III. Performance

R&D programs should maintain a set of high priority, multi-year R&D objectives with annual performance measures and milestones that show how one or more outcomes will be reached. Metrics should be defined not only to encourage individual program performance but also to promote, as appropriate, broader goals, such as innovation, cooperation, education, and dissemination of knowledge, applications, or tools.

OMB encourages agencies to make the processes they use to satisfy the Government Performance and Results Act (GRPA) consistent with the goals and metrics they use to satisfy these R&D criteria. Satisfying the R&D performance criteria for a given program should serve to set and evaluate R&D performance goals for the purposes of GPRA. OMB expects goals and performance measures that satisfy the R&D criteria to be reflected in agency performance plans.

Programs must demonstrate an ability to manage in a manner that produces identifiable results. At the same time, taking risks and working towards difficult-to-attain goals are important aspects of good research management, especially for basic research. The intent of the investment criteria

is not to drive basic research programs to pursue less risky research that has a greater chance of success. Instead, the Administration will focus on improving the management of basic research programs.

OMB will work with some programs to identify quantitative metrics to compare performance across programs with similar goals. Such comparisons may be within an agency or among agencies.

Construction projects and facility operations will require additional performance metrics. Cost and schedule earned-value metrics for the construction of R&D facilities must be tracked and reported. Within DOE, the Office of Science's formalized independent reviews of technical cost, scope, and schedule baselines and project management of construction projects ("Lehman Reviews") are widely recognized as an effective practice for discovering and correcting problems involved with complex, one-of-a-kind construction projects.

A. Programs may be required to track and report relevant program inputs annually. Programs may be expected to report relevant program inputs, which could include statistics on overhead, intramural/extramural spending, infrastructure, and human capital. These inputs should be discussed with OMB.

B. Programs must define appropriate output and outcome measures, schedules, and decision points. Programs must provide single-and multi-year R&D objectives, with annual performance measures, to track how the program will improve scientific understanding and its application. Programs must provide schedules with annual milestones for future competitions, decisions, and termination points, highlighting changes from previous schedules. Program proposals must define what would be a minimally effective program and a successful program. Agencies should define appropriate output and outcome measures for all R&D programs, but agencies should not expect fundamental basic research to be able to identify outcomes and measure performance in the same way that applied research or development are able to. Highlighting the results of basic research is important, but it should not come at the expense of risk-taking and innovation. For some basic research programs, OMB may accept the use of qualitative outcome measures and quantitative process metrics. Facilities programs must define metrics and methods (e.g., earned-value reporting) to track development costs and to assess the use and needs of operational facilities over time. If leadership in a particular field is a goal for a program or agency, OMB and OSTP encourage the use of benchmarks to assess the processes and outcomes of the program with respect to leadership. OMB encourages agencies to make the processes they use to satisfy GPRA consistent with the goals and metrics they use to satisfy these R&D criteria.

C. Program performance must be retrospectively documented annually. Programs must document performance against previously defined output and outcome metrics, including progress towards objectives, decisions, and termination points or other transitions. Programs with similar goals may be compared on the basis of their performance. OMB will work with agencies to identify such programs and appropriate metrics to enable such comparisons.

IV. Criteria for R&D Programs Developing Technologies That Address Industry Issues

The purpose of some R&D and technology demonstration programs and projects is to introduce some product or concept into the marketplace. However, some of these efforts engage in activities that industry is capable of doing and may discourage or even displace industry investment that would occur otherwise. Programs should avoid duplicating research in areas that are receiving funding from the private sector, especially for evolutionary advances and incremental improvements. For the purposes of assessing federal R&D investments, the following criteria should be used to assess industry-relevant R&D and demonstration projects, including, at OMB discretion, associated construction activities.

OMB will work with programs to identify appropriate measures to compare potential benefits and performance across programs with similar goals, as well as ways to assess market relevance.

A. Programs and projects must articulate public benefits of the program using uniform benefit indicators across programs and projects with similar goals. In addition to the public benefits required in the general criteria, all industry-relevant programs and projects must identify and use uniform benefit indicators (including benefit-cost ratios) to enable comparisons of expected benefits across programs and projects. OMB will work with agencies to identify these indicators.

B. Programs and projects must justify the appropriateness of federal investment. Programs and projects must demonstrate that industry investment is sub-optimal to develop a technology or system and explain why the development or acceleration of that technology or system is necessary to meet a federal mission or goals.

C. Programs and projects must demonstrate that investment in R&D and demonstration activities is a more effective way to support the federal goals than other policy alternatives. When the federal government chooses to intervene to address market failures, there may be many policy alternatives to address those failures. Among other tools available to the government are legislation, tax policy, regulatory and enforcement efforts, and an integrated combination of these approaches. Agencies should

consider that the legislation, tax policy or regulatory or enforcement mechanisms may already be in place to achieve a reasonable expectation of advancing the desired end.

D. Programs and projects must document industry or market relevance, including readiness of the market to adopt technologies or other outputs. Programs must assess the likelihood that the target industry will be able to adopt the technology or other program outputs. The level of industry cost sharing or enforceable recoupment commitments in contracts are indicators of industry relevance. Agencies must be able to justify any demonstration activities with an economic analysis of the public and private returns on the public investment.

E. Program performance plans and reports must include "off ramps" and transition points. In addition to the schedules and decision points defined in the general criteria, program plans should also identify whether, when, and how aspects of the program may be shifted to the private sector.